Light and Lighting

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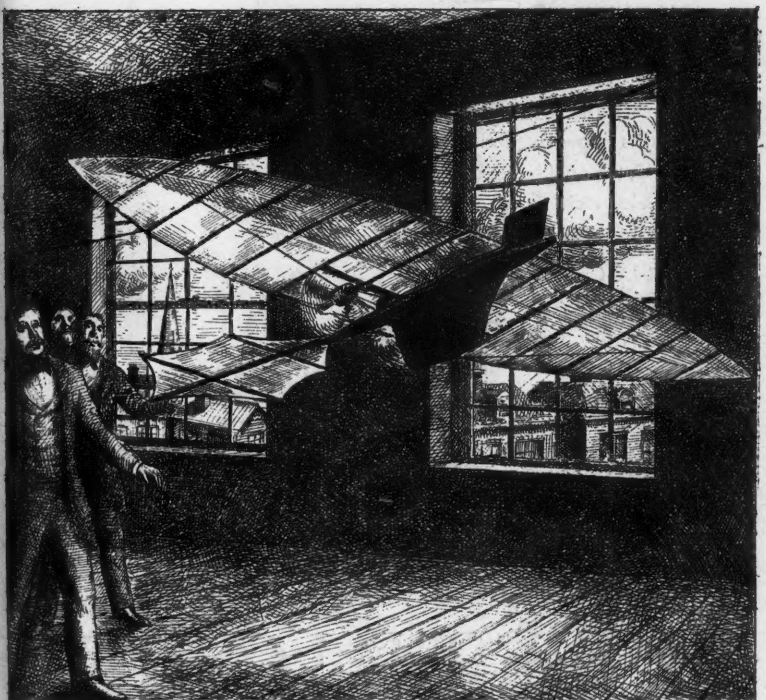

FIRST POWERED AEROPLANE. The first successful powered aeroplane was a model made by John Stringfellow. The forerunner of modern flying, it took the air for the first time in 1848 in a room at Chard in Somerset.

JOURNAL OF SEEING AND ILLUMINATION

Light and Lighting

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CONTENTS

The Forty-Second Volume

THE NEW YEAR upon which we have entered brings us to the forty-second volume of this journal. So, in offering our editorial good wishes to all readers, we venture to hope they will share our gratification that "Light and Lighting" has come to a goodly age and will wish it well in this and the years to come. We hope and believe it has a better expectation of life than it has had in years gone by; and we shall do our best to make it live vigorously and usefully. That the journal has reached its present age, despite the hazards of early life and those brought by two great wars, is due first and foremost to the late J. S. Dow, who was associated with it from its birth until his untimely death last August. We cannot let this issue go to press without paying one more tribute to him who, justifiably, would have been proud of this event.

Illumination Notes and News

Lighting Development in Norway

Through the kindness of Mr. Rolf J. Aspestrand we have received a copy of the annual report, covering the period from May, 1947, to April, 1948, of the Norwegian Lighting Development Association (Selskapet for Lyskultur).

This body holds meetings and arranges courses on somewhat similar lines to the I.E.S. in this country, though on a somewhat smaller scale, but it also acts in an advisory capacity to its members in drawing up plans for lighting installations. Possibly there are not sufficient qualified lighting engineers in Norway to take on such jobs, but it appears that during the period under review the Association completed some 50 jobs of this kind, including a number of large industrial concerns. It also appears that this project has official recognition to the extent that official inspectors are instructing industrial organisations to seek the advice of the Association in connection with their lighting problems.

The subject of windowless buildings is one which is receiving some attention. The Association has requested the Chief Inspector of Works to consider an amendment to the existing building regulations, which prohibit the use of rooms not provided with natural lighting as work rooms. It is pointed out that with modern light sources it is easy to obtain lighting as good as daylighting by artificial means and that provided the requirements for heating and ventilating are satisfied then there is no reason, after the installation of adequate artificial lighting, why rooms without windows should not be used as work rooms.

The increased use of electric discharge lamps in their various forms, and presumably the adoption of somewhat higher levels of illumination, has led people to make more use of light measuring instruments. There seems, however, to be an acute shortage of such instruments so that the Association have had to arrange for light meters to be borrowed from a central pool.

Technical courses in lighting are arranged by the Association, but it seems that these have been limited this year owing to the Norwegian equivalent to "load shedding." It is to be hoped that our own technical training programme does not suffer the same way.

The Next I.E.S. Sessional Meeting in London

On February 8 a paper entitled *The Lighting of Churches* will be presented by Mr. L. C. Rettig at a meeting of the I.E.S. to be held at the Lighting Service Bureau, 2, Savoy-hill, London, W.C.2, at 6 p.m.

The paper discusses the illuminating engineering principles applicable to the lighting of churches, bearing in mind the requirements of various denominations and styles of architecture. Illumination methods and associated fittings are classified, and their suitability and limitations for a number of situations are indicated.

Stage Lighting

The Illuminating Engineering Society announce that arrangements have been made for a visit to the London Palladium to see the stage lighting, to take place on the morning of Tuesday, February 22, from 10.45 a.m. to approximately 1 p.m.

The numbers taking part in this visit are necessarily limited and those I.E.S. members wishing to take part are asked to communicate with the secretary of the I.E.S., 32, Victoria-street, S.W.1, as soon as possible.

I.E.S. Annual Dinner

The I.E.S. have also announced that the Society's annual dinner will this year be held at the Café Royal, Regent-street, London, on Wednesday, May 11, i.e., on the day following the annual general meeting in London. Judging from the popularity of this event on previous occasions many I.E.S. members will wish to book this date well in advance. It is understood that full particulars will be issued by the I.E.S. very shortly.

Early Electric Street Lighting

A recent installation of modern street lighting with fluorescent tubular lamps in Moorgate, London, recalls that the firm responsible for this were also responsible for one of the earliest electric street lighting systems ever installed. This was in 1881 and it took the form of carbon arc lamps with carbons arranged to last 18 hours without renewal. They were estimated to give from 2,000 to 3,000 candle-power and undoubtedly caused a sensation in the City streets. Three of these lamps were erected, one near the Mansion House and Queen Victoria-street, one between the Bank and the Mansion House, and one nearer the Royal Exchange.

An interesting feature of the installation was the remarkable height at which the lamps were fixed. They were on latticed masts 75 *feet* above the level of the street. What a splendid example those pioneers set to modern street lighting engineers! Even if the lamp-standards did not come up to our present standards from the aesthetic point of view they did at least keep the glare of the arc lamps well above the line of normal vision. And was not some of the "splendid effulgence" as described in the Press of the day, due to the fact that the light came from on high?

The Application Of Optics To Industry

Too late for notice in the last issue of LIGHT AND LIGHTING was the announcement of a special series of lectures on the above subject which have been arranged by the Physics and Maths. Department of the South-East Essex Technical College, Longbridge-road, Dagenham. The lectures, which are intended for advanced students in engineering, chemistry, and physics, will be held at 7 p.m. on Tuesday evenings throughout the spring term and began on January 11. The lectures are to be given by members of the staff of the Hilger Division of Messrs. Hilger and Adams, Ltd.

The scope of the lectures is briefly as follows:—

Jan. 11—Feb. 1. (Four lectures.) Spectro-chemical analysis, by Mr. E. S. Dreblow.

Feb. 8, 15, Mar. 1 and 8. Absorption spectrophotometry, by Mr. Isbell.

Feb. 22. Interferometry, by Mr. T. L. Tippell.

Mar. 15—April 5. X-Rays and crystal analysis, by Mr. F. Brech.

The fee for the complete course is £1. Applications for entry should be made to the Clerk of the Governors of the College, enclosing the fee.

I.E.S. Discussion on the Paris Meeting of the I.C.I.

A brief account of the work of the technical committees at the 11th session of the International Commission on Illumination held in Paris from June 29 to July 7

An informal meeting of the Illuminating Engineering Society was held at Gas Industry House on December 8, when some of the British delegates to the session of the International Commission on Illumination, recently held in Paris, gave brief accounts of the work carried out during the course of the technical meetings.

Dr. J. N. Aldington, a vice-president of the Society, was in the chair, and Dr. S. English, who acted as leader of the British delegation in Paris, opened the proceedings with a general survey of the work of the session. He said that the Commission was faced with the task of picking up the threads of its work after an interruption of nine years due to the war, and it had, therefore, been expected that this session might not reach anything like the standard of previous sessions; the best that was hoped was that it would enable work to be recommenced and so pave the way for a fully effective session in a few years' time. However, it proved, said Dr. English, to be a very good session. Twelve countries were represented, and three, whose national committees were still being reconstructed, sent observers. The total number of delegates was well over 300, the British being the largest visiting delegation, with 67 members. It was most unfortunate that neither Sir Clifford Paterson, the hon. secretary of the Commission, nor Mr. Preston, the general secretary, were able to be present. The secretarial work was undertaken by Dr. Walsh.

The opening plenary meeting was held in the Richelieu Theatre of the Sorbonne, where the delegates were welcomed by M. Maurice Leblanc, chairman of the French National Committee. The opening address was given by M. Louis de Broglie, the most eminent of French physicists, who spoke of the physical theory of luminescence. Dr. Halbertsma followed with a demonstration of the practical applications of luminescence in the lighting field, and the proceedings concluded with a film of the life and work of Charles Fabry, the immediate predecessor of Dr. Halbertsma as president of the Commission. At the final plenary session, when all the technical recommendations prepared by the various committees during their meetings were approved, and other formal business was transacted, Dr. Halbertsma was unanimously re-elected president for a further term, Dr. König of Switzerland succeeded M. Trüb as hon. treasurer, Mr. C. A. Atherton, of the U.S.A., was elected hon. secretary, and Dr. Walsh was made one of the three vice-presidents. The next session was to take place in Sweden in 1951. Dr. English also referred to the various social functions which had been arranged by the French committee for the entertainment of the visiting delegates and their ladies, but these have already been described in a previous number of LIGHT AND LIGHTING.

The next speaker was Dr. W. D. Wright, who dealt first with the work of the Committees on Vocabulary and on Definitions. The former had approved the preparation of a new edition of the vocabulary published by the Commission, while the most important decisions of the Committee on Definitions were the adoption of the name "candela" for the unit of luminous intensity, and of "luminance" for brightness in the objective sense. The term "brightness" unqualified was ambiguous, and the only alternative to a new term was to attach some adjective such as "photometric." The symbol for luminance was to be L with B as a permissible alternative. The Committee on Light and Vision had recommended the preparation of data necessary as a preliminary to the adoption of a scotopic luminosity curve and had agreed upon the spectral distribution of the new standard of light as the reference distribution for relating the photopic and scotopic photometric scales. The Committee on Photometry had recommended a study of methods of choosing observers for visual heterochromatic photometry and of the most suitable size of exit pupil in visual photometers; a study of the relative merits of different methods of photoelectric heterochromatic photometry was also recommended.

The Colorimetry Committee, said Dr.

Wright, had made a large number of recommendations. It had decided not to adopt a quasi-equi-energy illuminant E and it had called for further study of the photopic luminosity curve. The description of the colours of illuminants by eight-band abridged spectrophotometry coupled with the chromaticity co-ordinates had been accepted. The Committee on Ultra-violet Radiation had recommended closer collaboration with the medical research workers and this matter was discussed at some length after Dr. Wright had concluded his remarks, particularly by Mr. Perry, Mr. C. W. M. Phillips, and Dr. West. Mr. Waldram posed the awkward question of the correct luminosity curve to use at a brightness level between the photopic and scotopic regions.

Mr. J. G. Holmes then gave an account of the work of the Committee on Light Sources. Great Britain was secretariat for this subject, and the excellent report presented had been prepared by Dr. Aldington and his collaborators, Mr. C. Sugg dealing with gas sources. The report of the Committee on Diffusing Materials was a good summary of the technical literature on the subject for the past nine years. The subject of the Classification of Lighting Fittings, said Mr. Holmes, aroused very little interest. With regard to traffic signals it appeared that standardisation was much more advanced in this country than elsewhere. The illumination of traffic signs was to be included at the next meeting of the Commission.

The Committee on Aerodrome Lighting held five meetings, at which some excellent papers were presented in addition to the secretariat report. One of these papers was by Mr. Calvert, of the Royal Aircraft Establishment. There was little uniformity in aerodrome lighting, said Mr. Holmes. Agreement was very necessary, but advance in this respect was a very slow process. A number of the details mentioned by Mr. Holmes in his report on this subject were discussed, particularly by Mr. S. S. Beggs, by Dr. English and by Mr. Waldram, who said that a major reason for the slowness of the advance towards agreement was the very large amount of money which had been put into existing systems.

Mr. L. G. Applebee then reported on the two subjects of Theatre Stage Lighting and Cinema Lighting. At the latter meeting it had been recommended that the subject of projection screens should be studied and an instrument developed for measuring screen brightness. The delegates on the subject of Theatre Stage Lighting had had a most useful opportunity of inspecting actual installations at several of the Paris theatres, including the Opera House. In the discussion Mr. Bicknell asked whether mention had been made of a carpet for cinema theatres in which the edge was treated with a fluorescent material and irradiated by "black" light. The chairman took up a point mentioned by Mr. Applebee and said that small projector lamps with pre-focus caps were made in a number of types in this country.

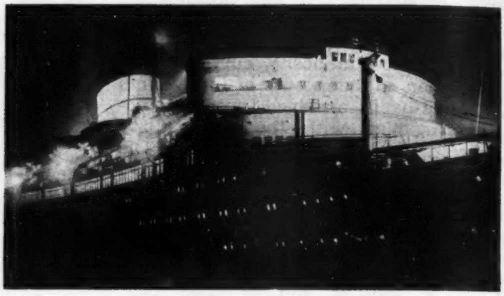
The last group of subjects, including Lighting Practice and Street Lighting, were dealt with by Mr. Ackerley. On Voltage Variations there was little to report. With regard to Lighting Education he mentioned that there seemed to be nothing abroad which corresponded to the I.E.S. lectures to school-children. Lighting Practice was an omnibus subject, including lighting in schools, offices, transport vehicles, etc. As would be expected, much emphasis was placed by the Americans on brightness contrasts and brightness distribution. There were some good papers, notably from M. Luckiesh and Ward Harrison, and an excellent discussion.

The meeting on Street Lighting was a very useful one, at which emphasis was placed on the need for a criterion of visibility in the street and for reliable statistics relating street lighting and accident rate. A paper by Messrs. L. J. Davies and W. D. Sinclair on fluorescent lighting in streets aroused a great deal of interest. There was also a good meeting on the subject of Mine Lighting, where again a paper by two British authors, Mr. R. Crawford and Dr. F. W. Sharpley, on the use of fluorescent lighting in mines had provoked considerable interest and led to a lively discussion.

In response to a request from the chairman, Dr. Walsh made some general remarks on the work of the Commission, and pointed out that some fairly extensive alterations in the methods of running the sessions were now overdue. The Commission had grown in 27 years from a membership the whole of which

(*Continued on page 26*)

LIGHTING ON THE CARONIA



The lighting of this vessel, which has just taken its place with other famous Cunard liners on the world's shipping routes, is fully in keeping with the many other features of design which make Caronia such an outstanding example of British skill and workmanship. The prevailing atmosphere in every public room is one of luxury and comfort, and the many delightful effects achieved by Mr. J. P. McBride, of Messrs. McInnes, Gardner and Partners, the architect responsible for design and decoration, are enhanced by the illumination from specially designed fittings supplied by The British Thomson-Houston Company, Ltd.

In each of the ship's main public spaces, a combination of fluorescent and tungsten lighting is skilfully employed to give adequate general illumination and a faithful rendering of colour schemes. In consequence, every intention of the architect and decorative artists, and the overall conception of rooms designed to provide the most appropriate atmosphere possible, are completely fulfilled.

In the two restaurants situated fore and aft, impressive use has been made of dark and light-shaded panelling and this feature is given due prominence by indirect fluorescent lighting. In addition, six sculptured glass panels stand out with great charm under this lighting. Tables are floodlit by tungsten units set in the deckhead. In the centre of the forward restaurant a series of fluorescent fittings, each designed in the form of a figure L for fixing against both bulkhead and deckhead, are, perhaps, the most outstanding units of the entire lighting scheme. These fittings, finished in gilt, give soft indirect lighting over the centre tables and add lustre to the moulded woodwork. Tungsten spot-lights, over the entrance and recessed into other parts of the deckhead, together with a number of decorative wall brackets, each designed for its particular location, lend brilliance and colour to the

One of the restaurants.

scene. In all, about a 100 lighting fittings are employed in these two restaurants.

In the private dining-rooms, which lead off directly from the forward restaurant, fluorescent fittings are employed to give both direct and indirect illumination throughout the room, while tungsten fittings are interspersed to give a well-balanced colour effect.

The first-class smoking-room.

In the lounges, too, the lighting forms an integral part of the decorative scheme. In the first-class lounge, some 70 fluorescent and tungsten fittings provide illumination which emphasises the elegant and restful atmosphere created by the architectural motif and furnishings. Ceiling panels and soffit troughs provide indirect fluorescent lighting in the cabin-class lounge, while tungsten fittings give directional lighting. As in the first-class lounge, the overall effect of the lighting is to enhance the decorative scheme and provide a restful environment. When darkness falls, the impression of artificial sunlight from the combined fluorescent and tungsten lights serves to enhance the almost tropical scene in the garden lounges. The effect is achieved by the use of concealed fluorescent lamps round the perimeter and fluorescent and tungsten lamps recessed in the main ceiling area.

A sweeping, curved recess around the edge of the deckhead in the observation lounge is used to conceal a number of fluorescent lighting units, and the illumination from these is supplemented by additional concealed fluorescent lamps and recessed tungsten spotlights. The oval-shaped cocktail bar has a distinctive lighting system which befits the contours of the space. The main feature consists of a "laylight" containing six fluorescent lamps in three double rows, which though unobtrusive, provides a high degree of diffused illumination.

The theatre aboard the Caronia is illuminated entirely by tungsten filament lamps in ceiling and wall fittings, and the aim has been to provide general illumination of a warm, inviting character. Open to sunlight in the daytime, the veranda café is aglow with illumination at night. A feature of outstanding beauty is a decorative sunburst over the centre of the space which glows with the light from tungsten lamps set into the deckhead.

The first- and cabin-class smoking-rooms, like the lounges, have been designed to provide a restful, relaxing environment for the passenger and here also lighting plays a major part in establishing the requisite impression of dignity and restraint. Indirect fluorescent lighting from cornices is employed in unison with tungsten lighting from recessed ceiling fittings and decorative wall brackets. In the first-class smoking-room, the main ceiling is in the form of three 12-sided figures stepped up in successive stages towards the centre. Each facet of this figure is illuminated by a concealed fluorescent lamp and its centre carries a dished fitting containing a number of tungsten filament lamps.

Throughout the ship, the lighting sets a high standard of efficiency, tastefulness and serviceability. Every detail of construction and design has been considered in relation to the types of lamps and fittings employed, and to their locations.

Transport Lighting

Summary of a paper presented at the I.E.S. Meeting in London on January 11, by Mr. H. R. Ruff, Mr. J. N. Hull, and Mr. R. V. Mills

The paper described recent developments which have resulted in the installation of fluorescent lighting in many types of road and rail vehicles and aircraft. In an analysis of the problem, the lighting requirements of vehicles leading to the use of numerous small-power lamps were explained. Power and weight limitations have always exercised the ingenuity of transport lighting engineers, whose task has been to spread a little a long way, but the shortage of space for the fittings is more severe for this new light source due to its larger size. The lower source brightness, however, provides compensations in the form of increased comfort and more even light distribution.

Fluorescent lamps can be made to operate directly from 50- to 150-volt D.C. supplies using thermal starters; tungsten lamp ballast is required below 70 volts, but resistor ballast is possible above 70 volts. Traction supplies of 400 to 600 volts D.C. may often be used directly, but introduce the problem of frequent interruptions at points and crossovers, requiring special starting circuits. Electromagnetic starters and experimental glow-thermal canister starters have both been used successfully for this purpose. Cataphoresis on D.C. is avoided by reversing polarity about every five hours; the rapid return to normal operation of a lamp which had been running for too long on one polarity was demonstrated.

Steam train compartment coaches are usually illuminated by a general overhead system, ranging from two 15-watt to three 20-watt lamps, the latter providing 7 lm./sq. ft. in service on the reading plane. Small filament lamps in reflectors or lens units may have an application as spotlights mounted on the rack or above the seats for illuminating the reading plane. Saloon coaches are treated similarly, but diners require extra table illumination which may be provided by filament table lamps. Motor alternator sets convert the 24-volt battery supply to 110 volts 400 cycles for the resonant-starting fluorescent lamp circuits.

Main-line electric trains have similar lighting installations, but the supply may be either direct from the traction circuit or from a motor-alternator set. Underground trains differ in layout and function and continuous lines of bare lamps are appropriate, supplied from a combined motor generator/alternator set.

Tramcars provide an example of efficient use of fluorescent lamps' characteristic low brightness and large size, where they replace rows of filament lamps behind heavily diffusing visors. In one case the illumination was raised from 2 to 10 lm./sq. ft., while the power from the supply was halved, the filament lamps ballasting the 30-watt fluorescent lamps being used to illuminate the indicators.

Space limitations in trolleybuses favour short fluorescent lamps in small enclosed lighting fittings and although little can be done to redirect the light efficiently a service illumination of 15 lm./sq. ft can be obtained, using a high-frequency motor alternator set supplied from the traction circuit. Lighting systems in buses and coaches vary considerably to conform with the different layouts; the limited power available from the battery is a handicap to fluorescent lighting.

Aircraft provide an extreme example of weight and space limitations so that special consideration is needed in each case to find the lighting system giving the best return for the inevitably increased weight. The small low windows tend to cause a dark ceiling which can be effectively eliminated by a bare fluorescent lamp installation such as that illustrated.

The degree of success achieved, despite the difficulties inherent in lighting transport vehicles, can be judged by the fact that for each watt of primary power approximately twice the lumens are now obtained from fluorescent as from tungsten filament lamps. Owing to the reduced degree of diffusion necessary with the lower brightness sources for equally pleasing lighting, the illumination can often be further increased several times. With this new lighting tool an average illumination of 10 to 15 lumens per sq. ft. is generally attained.

The Lighting of Southampton Docks

A Brief Description of Development in Dock Lighting Technique

The lighting of Central-road is carried out by means of 500-watt filament lamps in Simplex "Refrax" Lanterns mounted on steel columns at a height of 25 ft., with an overhang of 5 ft., at distances of 120 ft. along one side of the roadway. The road is 30 ft. wide and is bounded on one side by the railway and a pavement on the other. It leads to the "Ocean Dock," and, further on, to passenger and cargo sheds, and has very heavy vehicular and, at times, very dense cycle and pedestrian traffic. The lanterns are of the sealed non-ventilated type with induced internal air circulation to obviate internal condensation, and light control is obtained by means of single-piece symmetrical Holophane refractor bowls.

An interesting feature is that the auxiliary internal refractors normally associated with the use of filament lamps (to give increased light control in the vertical plane and increase the apparent "flashing" area of the glassware) were not fitted. It was found that the single-piece refractor gave adequate light control and, of course, it will be possible to substitute 400-watt or 250-watt mercury electric discharge lamps at any time without modification of the fitting—a course which may be taken after further experience has been gained. At present it is considered advisable to avoid the use of mercury discharge lamps until it is established that there could be no possibility of giving rise to any confusion with colour signals as seen by pilots bringing in vessels under difficult weather conditions.

It has been found that the lighting of this single main roadway, forming as it does a prominent landmark in the geography of the docks, does not interfere with the work of the pilots. It is necessary, however, to employ "cut-off" lighting for the remainder of the exterior illumination of the docks.

For the railway sidings, etc., deep dispersive weatherproof type industrial reflectors with 500-watt tungsten lamps are employed at a height of 25 ft. This is preferred to floodlighting from towers. The normal spacing is 100 ft., but special attention has been given to the illumination of points, at least one lamp always being located in a carefully selected position adjacent to each junction. This has been found most beneficial for shunting operations which, in this instance, differ quite appreciably from those of normal marshalling yards.

At 46/47 berths in the "Ocean Dock," from which the large transatlantic liners depart, the shed lighting is by means of 1,000-watt filament lamps in distributing type vitreous enamelled reflectors with cylindrical metal skirts, also finished in vitreous enamel, to obviate glare. These units are mounted at a height of 20 ft., and the sheds are illuminated by two rows of fittings with a 50-ft. spacing, the rows being 60 ft. apart. These sheds are used for the examination of passengers' baggage and are bounded on one side by the quay and on the other by the railway, from which the boat trains leave. The lighting here provides an illumination of approximately 4-5 ft.-candles over the whole working area, with a minimum of not less than 2 ft.-candles near the wharf. This has been found adequate to meet the rather exacting requirements of the Customs' officials, and compares favourably with the 1.5-2 ft.-candles which were provided pre-war.

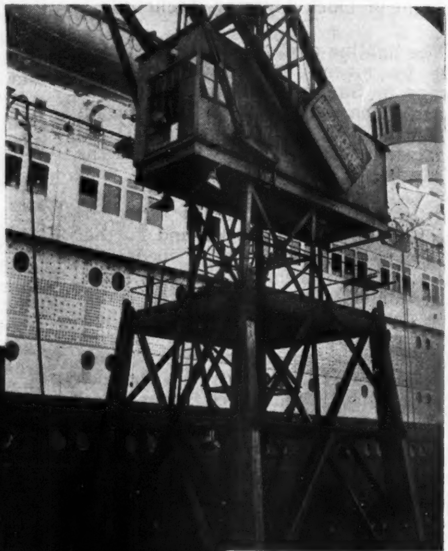
It is understood that this lighting, which has also been installed in the Channel Islands' transit sheds, is so satisfactory that it will be incorporated in the ground floor of the new "Ocean Terminal" building which is being erected at 43/44 berths in the "Ocean Dock," and will represent a great advance over anything previously built to facilitate and expedite the handling of both passengers and cargo.

The lighting of the quayside is carried out by means of 200-watt filament lamps mounted in a special miniature form of the Simplex "Reflectorflood" unit to the design of Mr. E. S. Ely, M.I.E.E., the Chief Electrical Engineer to the Docks. The units are mounted on the walls of the sheds just under the eaves at 60-ft. spacing; resulting in an average horizontal illumination of the order of 0.25 ft.-candle. The units are fully adjustable and are carefully set so that there is a cut-

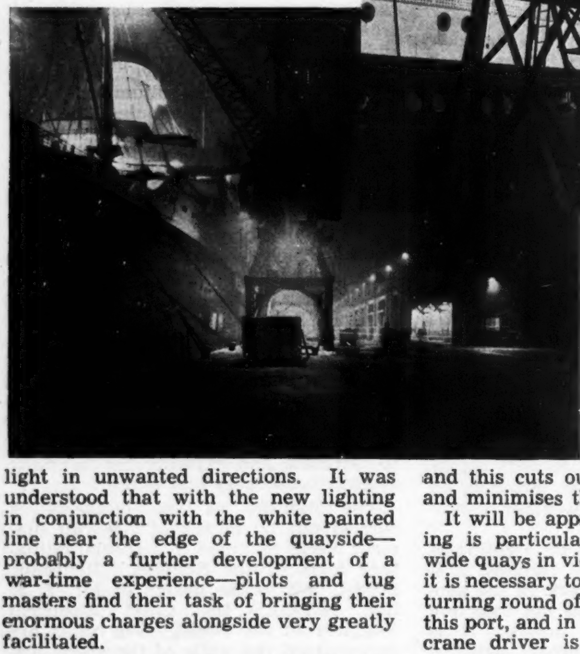
off of light in the forward direction at the quayside edge and a spill-shield at the back prevents the development of bright spots of light on the walls or doors of the sheds.

This system is clearly a development of a war-time technique with somewhat similar "scuttle" type lighting fittings when, of course, it was necessary for quite different reasons to prevent a spill of light on to the water. Experience under this form of lighting did, however, emphasise the fact that remarkably satisfactory lighting results could be obtained with minimum energy consumption providing glare was obviated by carefully controlled cut-off of light in unwanted directions. It was understood that with the new lighting in conjunction with the white painted line near the edge of the quayside—probably a further development of a war-time experience—pilots and tug masters find their task of bringing their enormous charges alongside very greatly facilitated.

Similar close attention to detail has been given to the problem of crane lighting, and, contrary to usual practice, no swinging lights are fastened to the jib. Instead two units similar to those installed for the quayside lighting are mounted on the underside of the control cabin which rotates with the jib; these also are equipped with 200-watt lamps. In addition two further units, but each with 300-watt lamps, are mounted each side of the crane gantry, to augment the quay lighting. With this arrangement the crane driver is, in effect, above the level of the lights and this cuts out the question of glare and minimises the effects of sea mist.



Above — Showing the lighting fittings under the cab and gantry on a crane.



Below—The quay lighting in the new docks.

It will be appreciated that good lighting is particularly important on these wide quays in view of the speed at which it is necessary to work to effect the quick turning round of the large liners that use this port, and in view of the fact that the crane driver is stationed some 50 ft above the quay level.

In this article it has been possible to describe only a part of the lighting in these extensive docks and to mention some of the recent improvements.

Fluorescent Lamp Radiations

By H. R. RUFF,* B.Sc., M.I.E.E.

Owing to the outstanding advantages of fluorescent lamps, there are now many millions in use all over the world. With so many installations it would be strange indeed if all these were perfect, and the remarkable feature has been that complaints have been so few. We have met one or two cases where the basic cause of the complaint has been bad lighting—the placing of lamps to give harsh contrasts or too little light at the work point—but we have yet to meet a case where the lamp radiation has been found injurious. One or two articles suggesting the presence of such effects, and scientific examinations(1) refuting such arguments have appeared here and in America. The extent to which it is now possible to dispel any suspicion concerning radiation from any lamp is not generally realised.

Some of the suspicion is based upon the fact that quite different effects can be obtained from two apparently similar light sources. The reason for this is that while the eye is a most sensitive detector of light it is not a suitable instrument for analysing any white light into its component wavelengths or colours. It judges the radiation from any source simply by its colour appearance in terms of three functions most easily considered as redness, greenness, and blueness. Since similar appearance may be obtained by combinations of either all visible wavelengths or of only two or more wavelengths very different rendering of coloured materials can be obtained from apparently similar light sources.

This may engender suspicion if the shortcomings of the eye in this respect are not fully appreciated. If visible radiation can be mysterious, how much more so may be the effects of invisible Ultra-Violet (U.-V.) or Infra-Red (I.-R.) Rays.

The antidote for all suspicion is knowledge: the handmaid to the collection of knowledge is the development of suitable detecting and measuring instruments. The extent of the field of measuring instruments and the improvements in their accuracy and reliability in the last few decades has been enormous as will be well appreciated by visitors to the annual exhibitions of the Physical and Optical Societies.

The splitting of white light into its component colours by glass prisms or gratings is generally well known. By choosing suitable materials the ultra-violet and infra-red rays can be similarly dispersed for analysis. Precision spectrometers, spectrographs and monochromators enable these wavelengths to be isolated and determined, and there is now a wealth of thermopiles, bolometers and photocells by means of which the intensities of both visible and invisible rays can be accurately measured.

It is interesting to realise that the currents obtained from these radiation detectors are only of the order of one millionth part of a millionth of an ampere, but in suitably equipped laboratories it is possible to measure such currents with an accuracy of about two per cent.

Rays From Lamps

Since it is difficult easily to appreciate a large number of individual wavelength intensities it is helpful to group these into bands having closely common characteristics. Much work has been done and still continues in connection with defining the largest possible groups to enable satisfactory appreciation to be obtained from consideration of a minimum number of values.

In Table I an attempt has been made to group as simply as possible the rays that may be given out from any natural

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* Research Laboratory, B.T.H. Co., Ltd., Rugby.

(1) Radiant Energy from Fluorescent Lamps. M. Luckiesh and A. H. Taylor. Ill. Eng., Feb., 1945.
Fluorescent Lighting. Can there be Harmful Effects? Brit. Med. Jnl. March 30, 1946.
Fluorescent Lighting and Eyesight. Sir Clifford Paterson. Elec. Times, December 19, 1946.

Table 1.
LIGHT RAYS

Ultra-Violet			Visible	Infra-Red
Short	Medium	Long	V.I.B.G.Y.O.R.	
Blistering	Sunburning	Inactive	Colours	Heating

or artificial light source. Natural sunlight and light from all artificial sources contain some invisible radiation as well as visible light in both the shorter wavelength (U.-V.) and the longer wavelength (I.-R.) regions. In the same way that it is often convenient to consider the light in the visible spectrum divided into its various colours—shown on our diagram by the initial letters of Violet, Indigo, Blue, Green, Yellow, Orange and Red—it is also convenient to consider the ultra-violet divided into three regions which we have referred to as Long, Medium and Short wavelengths respectively.

There is an important amount of radiation in all these bands excepting the short U.-V. band in the light we receive from the sun.

Biological Effects

As a simple description of the biological effects of these rays, infra-red rays cause heating, and the distribution of radiation over the visible region defines the colour quality of a light source. In describing the ultra-violet region, the long region has been termed as inactive, the medium region as sun-burning, and the short region as blistering.

While a better description for this short region would be welcomed, the term "dangerous" has been deliberately avoided since, with all these bands, the effects obtained depend upon the intensity of the radiation received and the time for which it is in action. By the term "blistering" it is meant to imply that a very small dose of the radiation can have a considerable effect on skin and eyes.

The close collaboration of many medical and physical investigators has enabled many biological effects to be studied and the relative effects of the different wavebands to be determined. In Fig. 1 some of this data is collected in graphical form. At the long wavelength end is part of the visibility curve—the effect of wavelength on the visibility of radiation. For appreciable biological effect, U.-V. wavelengths shorter than 3,250Å are required, and certain wavelengths are much more effective than others for a given purpose. Possessing this type of data, it is then possible to set safe limits for any given wavelength, such limits being a function of both the intensity of the energy and the time for which it is operating.

To show how these are inter-related, for instance, infra-red radiation—in

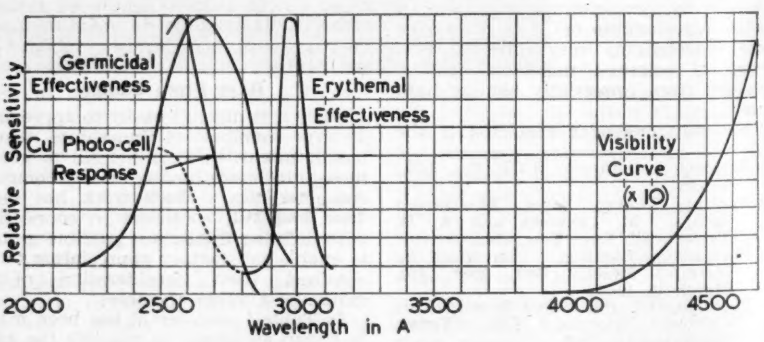


Fig. 1. Sensitivity data.

Table 2.

APPROXIMATE COMPARISON OF U.-V. AND TOTAL RADIATION INTENSITIES FROM THE SUN AND FLUORESCENT AND INCANDESCENT LAMPS

Light Source	Radiated Power per Lumen (milliwatts)			Normal Light Intensity Lumens/ Sq. Ft.	Normal Radiated Power (milliwatts/sq. ft.)		
	Erythemal Region 2900–° 3250Å	Near U.-V. 3250–° 4000Å	Total U.-V. Visible and I.-R. Radiation		Erythemal Region 2900–° 3250A	Near U.-V. 3250–° 4000Å	Total U.-V. Visible and I.-R. Radiation
Noon Sunlight 42 deg. N.(1)	0.04	0.5	9.4	8,500	330	4,000	80,000
Fluorescent(2)	0.04	0.2	10.0	50/10	2.0/0.4	10/2	500/100
Incandescent	0.001	0.08	62.0	50/10	.05/.01	4/0.8	3,100/620

(1) Germicidal Erythemal and Infra-red energy, M. Luckeish, page 48. Tests made clear midwinter gave 0.1 erythemally weighed U.-V. of midsummer.

(2) Research Laboratory measurements.

normal intensities pleasantly warming and invigorating—can at intensities of the order of 500 watts per sq. ft. act as a death-ray for killing insects, which die in a few seconds if subjected to this high intensity.

At the other extreme, at the recent C.I.E. Meeting in Paris it was generally accepted that an intensity of short U.-V. (2,537Å) of one ten-thousandth of a watt per sq. ft. is safe even for small children exposed for periods of 24 hours per day.

Fluorescent Lamp Radiation

Considering the radiation from fluorescent lamps, partly coated fluorescent lamps have been used many times to demonstrate the fact that the discharge is designed so that it generates U.-V. for the fluorescent powders to convert into visible light.

This U.-V. is in the short wavelength region and certainly if this radiation were to come out from the lamp, the lamp would be most dangerous. It is not radiated due to the well-known absorption properties of normal glasses, a statement that can be proved by measurements.

Photo-electric cells can be made in such a way as to " see " only the particular region of the U.-V. range in which one is interested. The sensitivity curve of a useful surface for short U.-V. measurements—a copper surface—is included in Fig. 1. Such cells enable measurements to be made which are completely unaffected by variations of visible light.

By means of equipment with which it is possible to measure accurately intensities of one-tenth of those which are accepted as being safe for continuous exposure of young children, we are unable to detect the presence of any short U.-V. if placed right against the tube wall of normal fluorescent lamps. These results thus indicate that, outside the lamp, there should be no biological effect whatever from the short U.-V. which is used for exciting the fluorescent powders.

Medium U.-V. which is present in sunlight is at times very much sought after. It appears to be impotent in small quantities, useful in moderation and dangerous with over-exposure. Spectrographic examination can show the presence of a small amount of energy in this region in the radiation from the fluorescent lamp. It is thus important to consider the quantity in which such radiation is present. Some measurements are summarised in Table 2. It is interesting to realise that for each footcandle of fluorescent lamp light and sunlight, one receives practically the same amount of sunburning radiation. Under mid-summer noon conditions, however, there are light intensities of approximately 8,500 footcandles, whereas indoors a light intensity of 50 footcandles is high. With this intensity the amount of this medium U.-V. from a fluorescent lamp is only approximately one one-hundred-and-fiftieth of that encountered in sunlight. Authorities will agree that

this amount is certainly well within the safe region for all normal human beings. One or two authorities anticipate that some slight beneficial effect might result from exposure, but with all normal indoor lighting conditions it is generally expected that there would be no detectable biological effect whatever.

Long U.-V., as described in Table 1, is generally considered as biologically inactive. Since, however, all such descriptions depend upon intensity, it should be noted that in 50 footcandles of fluorescent lighting there is less than one four-hundredth of the amount of this long U.-V. in summer daylight.

Since one set of invisible rays—the ultra-violet have been studied—the infra-red radiation from the fluorescent lamp should be considered. Very little time need be spent over the point since the fluorescent lamp is easily the coolest of general lighting sources. At normal intensities the amount of energy received on any surface is negligibly small.

The picture might perhaps be completed by an examination of the colour of the light from the lamps. The only effect known of the line radiations typical of electric discharge lamps is that these can distort colours. The band radiations given from fluorescent powders enable fluorescent lamps to have a light closely similar to daylight or incandescent lamp light from the point of view of freedom from colour distortion.

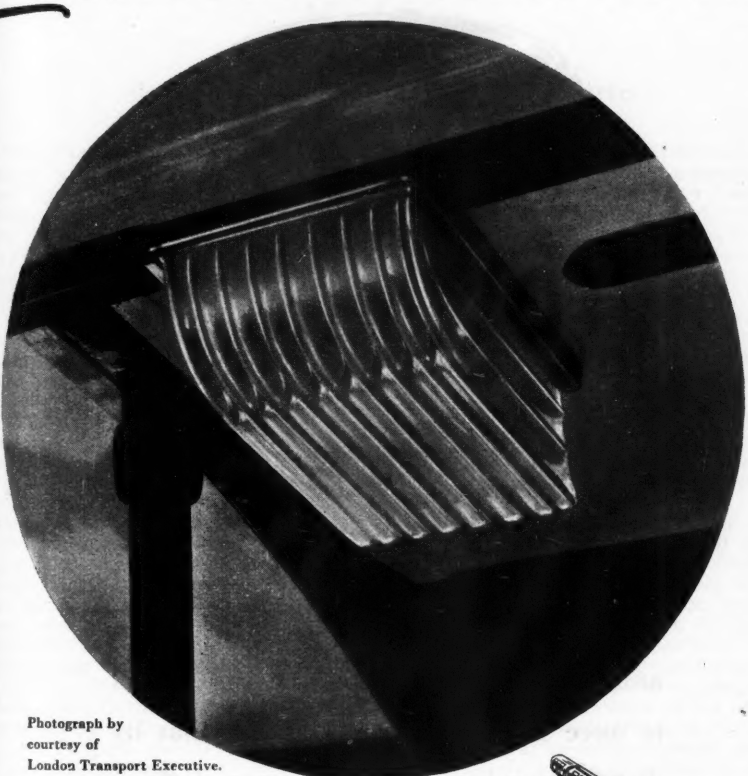
Conclusion

In this brief article an attempt has been made to condense the wide knowledge concerning the radiation from fluorescent lamps into a form that will give a mental picture of the relation between natural and artificial lighting.

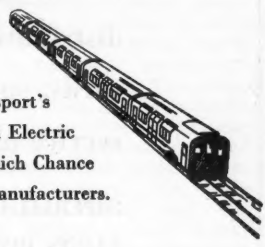
There are now many million fluorescent lamp points installed here and in America and it would seem that the general satisfaction in service fully supports the deductions from scientific measurements that individuals who experience no difficulties out of doors can fully enjoy the benefits of fluorescent lamp lighting.

I would like to thank Mr. L. J. Davies, Director of Research of the B.T.H. Co. Ltd., for permission to publish this article.

Chance LIGHTING GLASS



Photograph by courtesy of London Transport Executive.



The familiar shovel-shaped lighting fitting of London Transport's newest tube cars is made by Chance Brothers for Benjamin Electric Ltd. It is one of a large number of specialized fittings which Chance Brothers regularly supply to the leading electric lighting manufacturers. *Enquiries regarding the manufacture of lighting glass to special designs are invited.*

CHANCE BROTHERS LIMITED *Glass-makers since 1824.*

Head Office and Works : Smethwick 40, near Birmingham. London Office : 28 St. James's Square, S.W.1.

Branch Works at Glasgow, St. Helens and Malvern.

Colour and Lighting in Factories and on Machines

Report on a recent three-day course

The Council of Industrial Design, jointly with the British Colour Council and the Building and Paint Research Stations of D.S.I.R., arranged a three-day conference on Colour and Lighting in Factories which was held at the Royal Institute of British Architects on Nov. 24-26, 1948. The conference has aroused a considerable amount of interest amongst industrial designers and architects, and the points that were discussed undoubtedly border on the province of the lighting engineer.

The trend of the conference was towards the functional rather than the decorative use of colour, and towards the subjective rather than the photometric aspect of lighting. To many attending the conference, the use of colour to assist in the efficiency of factory operations was a startlingly novel implication, and it appeared equally arresting to the uninitiated to hear lighting engineers advocating methods for the subjective assessment of lighting quality, rather than the photometry of lighting quantity. These ideas must have been in accord with the attitudes of many of those attending the conference, judging by the interest displayed in the subsequent discussion.

The lectures dealt with a number of specialised points of view. Mr. P. J. Gay, of the Paint Research Station, outlined the mechanics of paint, and succeeded in demonstrating the possibilities and the improbabilities of the future development of paints. New synthetic chemicals have enlarged the range of colouring materials, in colour, texture, miscibility and durability. Covering power of paint is to a large extent a function of particle size and shape, but in practice a most essential factor in good coverage is the cleanliness of the surface before the application of the paint; this in turn governs the durability of the surface.

This was the only paper to deal with the technique of colour application, but several papers discussed the purpose and theory of colour treatment. Two of these, by Dr. Ling of the Roffey Park Rehabilitation Centre, and by Mr. D. Medd, of the Schools Section of the Hertfordshire County Architect's Division, dealt with specific problems. Dr. Ling dealt with the whole problem of environmental factors and their influence on industrial welfare; how they affected absenteeism, accidents and industrial neurosis. He showed a colour film of the work of the Roffey Park Centre, which gave a clear idea of the ways in which industrial workers on the borderline of breakdown can be restored to mental health.

Mr. Medd's paper described the bold and exciting colour treatment of some new school buildings in Hertfordshire. These schools have been planned to the 5 per cent. daylight factor recommended by the Ministry of Education and the colour treatment has in no way fallen behind this courageous designing. The aim has been to tell the truth about the structure—the reverse of the art of camouflage—so that structural features are picked out by colour contrast. Large panels of vivid hues, separated by divisions of neutral, restful colours, serve as a stimulus in corridors, the dining-room, and the assembly hall. The classrooms are coloured in a less positive manner, but in the infants' rooms the use of stimulating juxtapositions of colour on cupboard doors adds to the sense of light and freshness. Mr. Medd and his colleagues have used the Ostwald Colour System in their work, and this led to a subsequent discussion in which the merits of the Ostwald and the Munsell systems were debated, Mr. Norbert Dutton, the industrial designer, reporting that he had himself used the Munsell system for preference.

The functional use of colour was discussed in papers by Mr. H. D. Murray,

Mr. Robert Wilson, Mr. H. Grimshaw and Mr. W. A. Allen. A certain degree of divergence could be detected between the approach of the technician, the artist, and the architect. The consultants with "artistic sensitivity" have a cautious outlook on the "cream and green" type of factory colour scheme, but those concerned with "making things work" appear to have a more embracing attitude. Mr. Murray reported a particular green colour (Munsell 5G—2/3) which appeared from experience to have a restful effect. This was one of the few specific recommendations on colour treatment that emerged, although Mr. Allen dealt with a number of detailed principles which could readily be translated into practice. His main thesis was that the use of colour in factories should be to make the work easier. Vision is a result of contrasts of light and colour, and in the same way as good lighting is designed to give good contrasts of light, good colour treatment should be designed to ease the visual task by enhancing colour contrasts, or by providing colour contrasts to assist vision in cases where brightness contrast alone was insufficient. Mr. Allen demonstrated by colour slides and a film how these ends could be achieved in particular cases.

Dr. W. D. Wright outlined the fundamentals of colour vision, and showed how these factors governed the characteristics of coloured surfaces. He illustrated the fact that, whilst yellows, and to a lesser extent, reds and oranges could be both bright and saturated, greens and blues could not be both at once. Research on new pigments might improve these colours to a useful extent.

Lighting matters were discussed by Dr. R. G. Hopkinson, Mr. E. B. Sawyer and Mr. Grimshaw. All three speakers made a special point of the need for glare-free lighting, and of the deleterious effects of badly planned installations. Dr. Hopkinson introduced the conception of the quality of lighting as the criterion of excellence, and described by experimental demonstrations the difference between luminance (photometric brightness) and luminosity (apparent brightness), and between discomfort glare and glare which actually reduces visual efficiency. Mr. Sawyer also discussed glare, and both lecturers emphasised the need for adequate amounts of light for factory work. The analytical basis of the I.E.S. code was explained, and the need for illumination levels at least as high as those recommended by the code was stressed. Dr. Hopkinson pointed out that high illumination was only of value when it produced proper brightness contrasts, since all seeing depended on contrast. The illumination level was, therefore, only a means to an end, and this end, adequate brightness and contrast, must not be lost sight of.

Relatively little emerged about the special value of fluorescent lighting, although Mr. Sawyer discussed colour rendering of the different types of fluorescent lamp. Maintenance and elimination of flicker were two factors which might have had more prominence.

The last afternoon of the conference was devoted to a "Brains Trust" discussion. Most of the questions showed that the main points made by the lecturers had gone home. On the lighting side, the problem of eliminating glare was obviously of interest, both for factories lighted by natural and by artificial light. Clear glass was advocated for factory windows, rather than diffusing glass, in order to avoid harsh contrasts between window and interior. Windowless factories were discussed, Dr. Hopkinson coming down heavily against them, but Mr. Sawyer pointing out that with skilful lighting they could be quite pleasant to work in.

The proceedings of the conference are being circulated to all those who enrolled for the conference, and in response to the enquiries which have since come in, the Council of Industrial Design may subsequently publish the papers. At the moment, members of the I.E.S. who would like to follow up should get in touch with Mr. Basil Marriott, Chief Training Officer, Council of Industrial Design, Tilbury House, Petty France, London, S.W.1.

'Photometry' by Walsh

From time to time we receive inquiries for books which are often out of print and difficult to obtain. One classic which is always in demand is Dr. Walsh's book on "Photometry." If any reader has a copy of this book for disposal we would be glad to know.

New Lighting Installations

Lighting in a Coachwork Factory

A fluorescent lighting installation has been planned and supplied by the General Electric Co., Ltd., for the new Bridlington factory of the Yorkshire Equipment Co., Ltd., motor bodybuilders. This factory, the first to be completed on the Bessingby Industrial Estate, is a converted blister hangar, which was acquired from the Air Ministry *en bloc*, dismantled, and re-erected on site with certain additions, principally that of a completely insulated roof.

In planning the lighting it had to be borne in mind that the working plane may vary from floor level to the top of a double-deck public service vehicle; also, that a good vertical component was necessary, and that the level of illumination on the normal working plane should be at least 15 lumens per square foot.

The type of work at this factory, namely, the building of new bus bodies and the renovation of old ones, involves a manufacturing stream in lines running lengthwise with the buildings, and consequently the lighting scheme has been arranged along similar lines. Five rows of G.E.C. twin-lamp 80-watt trough reflectors have been installed. Altogether, the main overhead lighting is provided by 83 twin-lamp fittings, and the illumination at floor level is about 15/17 lumens per square foot. The advantage of a low surface brightness source is strongly emphasised by the lack of glare either directly or, more especially, indirectly from the highly polished metal surface of the bus bodies before painting.

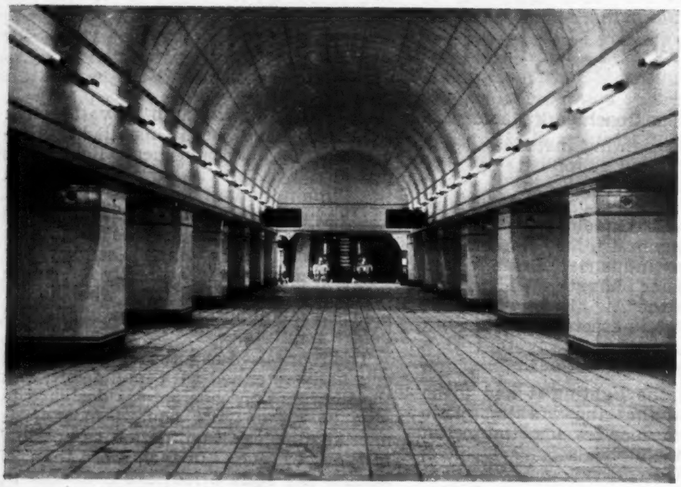
The room used as a drawing office was originally intended as a mould loft, and the illumination scheme was designed to give 25 lumens per square foot of as near shadowless illumination as possible at the floor level. In fact, more than 30 lumens per square foot are available at desk level, and the distribution is very even. The room is lighted by eight two-lamp 4 ft. fluorescent fittings.

The electrical contractors were Messrs. W. E. Marriott, Bridlington, under the instruction of the architect, Mr. W. S. Cook.

Lighting in the Underground

The new extension to the Central Line of London's underground railway

Interior of the converted hangar now used for bus body-building.



Showing the fluorescent lighting at the new Gants Hill Underground Station.

has already become part of the everyday lives of millions who travel to the city and beyond.

One of the outstanding features of the modern stations along this line is the "daylight" illumination provided by fluorescent lamps in fittings specially designed to the specification of the London Transport Executive. Combining with the superb construction of each main station—speedy escalators, excellent ventilation, attractive appearance and spaciousness—the new lighting system helps to demonstrate to British and overseas visitors alike the engineering skill which has gone into this outstanding post-war development.

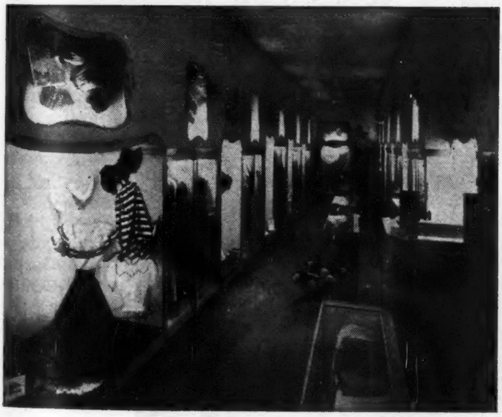
The fluorescent lighting is shown to full advantage in the Bethnal Green, Gants Hill, Wanstead and Redbridge Stations, where fittings supplied by the British Thomson-Houston Co., Ltd., are employed. The entrance to Gants Hill Station takes the form of an adequately yet not excessively illuminated subway, the lighting being sufficiently "warm" to create a comfortable atmosphere and of an intensity which permits comfortable vision. Occasional emergency fittings which are equipped with tungsten lamps provide a standard of comparison between old and new forms of lighting and emphasise the improvements which have been made. The actual fittings used have been designed with due consideration of maintenance problems such as the need for lamp replacement and are of a pattern based on the original design used in the first installation of this kind—at Piccadilly Circus Station. The auxiliary gear for each lamp is accommodated in shallow metal troughs, at each end of which a bracket arm carries a spring-loaded lamp holder. To replace a defective lamp one end is pushed into a holder and the free end is allowed to slide into the opposite holder. Thus the lamp is firmly held in a horizontal position. The lamps employed are all of the 80-watt "daylight" type which ensures a natural colour rendering. Some operate on 33⅓ cycles and others on 50 cycles. Two independent supplies are used as a precaution against breakdown. The spacing is such that even light distribution is obtained over all surfaces with total absence of harsh shadows. Another notable feature is the complete absence of glare.

The lighting of these underground stations presents a bold contrast to many existing lighting schemes. And of considerable importance is the fact that the fittings admirably blend with the effective architectural design of each station.

Lighting In A Dress Shop

A novel installation of fluorescent lighting for general illumination and display purposes has been completed at the Croydon branch of Neatawear Limited, ladies' fashion specialists. The 2-ft. 20-watt lamps which were introduced last July have proved particularly convenient for this installation, where both the indirect lighting of the shop and illumination of special displays derive from lamps concealed in the bases of decorative display features round the walls above the ordinary showcases. These features are of such dimensions that a 4-ft. lamp could have been accommodated only by recessing its ends into the wall. The solution has been to mount two 2-ft. lamps side by side in an inverted fitting in each feature, thereby overcoming the replacement difficulty and concentrating the light where it is needed. The lamps are operated in series.

Below—Showcases lighted by 2-ft. fluorescent lamps.



The display features are known as "shadow boxes," being designed to give a perspective effect rather than flat lighting to the goods shown in them. At the same time the light thrown outwards and upwards from the boxes gives uniform general lighting to the shop by reflection from the cream-coloured walls and ceiling.

There are 21 shadow boxes with the 2-ft. lamps, together with two somewhat larger boxes at the ends of the shop, each containing a 4-ft. lamp. These are placed at an angle so as to be seen through the windows. Each showcase contains one 4-ft. lamp and two 4-ft. lamps light the window display.

Above—General offices of Gillette Industries Ltd.

The contractor for the installation was M. Hyams, London, S.E.5.

Office Lighting

The ingenuity displayed in overcoming lighting installation problems presented by new types of building construction is demonstrated in the accompanying photograph of the General Offices of Gillette Industries, Ltd., Great West-road, Isleworth, Middlesex.

In these offices the ceiling construction prevented the suspension of fittings direct from the ceilings. Resort was therefore made to the walls and longitudinal roof beams. As will be seen, care in aligning the fittings and chain suspension, coupled with a high standard of installation work on the part of the engineering staff of Gillette

Industries, Ltd., produced a most pleasing result.

The installation was planned by the Illuminating Engineering Department of Messrs. Siemens Electric Lamps and Supplies, Ltd., in co-operation with Mr. S. A. Strode, A.M.I.E.E., the chief electrical Engineer of Gillette Industries, Ltd. "Sieray" 80-watt open top dispersive reflectors spaced on approximately 8 ft. by 7 ft. centres, were used to give a lighting intensity of 20 lumens per sq. ft.

A Railway Inquiry Office

During 1948 the Southern Region of British Railways opened a new Continental Inquiry Office at Victoria Station, designed on modern lines and with accommodation fitted for the amount of traffic likely to be dealt with at this important "Gateway to the Continent."

The premises were reconstructed from a building formerly used as warehouse, and opportunity was taken to install up-to-date lighting features, as will be seen from the accompanying illustration, for which we are indebted to the Southern Region. The principal lighting is arranged over the counters by lines of fluorescent tubes. These have been encased in special fittings with bronze end pieces and opalescent "Perspex" in lieu of glass.

A further feature is the special cornice lighting round the central stanchions. It will be noted that the original steelwork has been well disguised and the exceptionally even effect of the cornice lighting is largely due to the fact that rings of cold cathode tubes have been arranged in the troughs just below the ceiling. This was found to be more satisfactory than the use of a series of separate lamps and, as special care was taken to obtain a surface on the cornices which harmonised well with the colour of the cold cathode tubes, the resultant effect has been unusually good.

The lighting fittings over the counters were supplied by Messrs. George Forrest and the cold cathode tubes for the central fittings by the General Electric Company. The whole of the installation work was carried out by the Southern Region Electric Lighting Department.

Forthcoming Lecture in Newcastle

It is announced that Dr. J. N. Aldington is to repeat his recent successful lectures on "Darkness into Daylight" at the City Hall, Newcastle-upon-Tyne, at 7 p.m., on February 8. The chair will be taken by the Lord Mayor of Newcastle.

The Continental Inquiry Office at Victoria Station, London.

I.E.S. ACTIVITIES

Bath and Bristol Centre

At a meeting of this Centre on January 7, Mr. D. E. Beard repeated his paper on Sports Lighting which he had given to the Exeter Group on the previous day. The subject, he said, was one which seemed to have been forgotten in post-war years in this country, the only outstanding installation being in connection with the recent Olympic Games. In his paper Mr. Beard set out some of the basic visual tasks encountered in sports lighting of many kinds, and made suggestions regarding the lighting requirements.

A study of the visual task shows that there are a number of variables which must be taken into consideration, e.g., size of object, location, and path, background brightness, location of observer. Diffuse illumination designed for uniformity and control of both object and background brightness should be the aim of any installation, whilst every care should be taken to avoid glare. The lighting of both vertical and horizontal areas had to be considered, and it was suggested that very good results could be obtained indoors by the use of an indirect lighting system provided the ceilings, walls and floor had a sufficiently high reflection factor.

The author suggested that outdoor sports arenas might be considered as large rooms with black ceilings and walls. The "ceiling" height in such cases might be taken as 40-50 ft. for most games, and uniform distribution is normally obtained by a sufficient number of direct lighting units.

The author concluded with some recommendations for lighting for badminton, billiards, boxing, gymnasia, football, tennis, and racing tracks.

Birmingham Centre

A very successful joint meeting with the Electrical Contractors' Association and the Society of Supervising Electrical Engineers was held on December 3. The lecturer was Mr. W. A. R. Stoyle, who lectured with demonstration and slides, on the "Maintenance of Fluorescent Lamps and Auxiliary Gear." The lecture was very detailed, and Mr. Stoyle showed some very ingenious and useful gadgets for testing the electrical constants of fittings in installations without having to take them down.

One E.C.A. member said that there was a real need for information of this type, and he quoted an instance of one of his service men plugging five canister switches in succession into a faulty fitting and burning them all out.

The discussion was lively and covered a wide range of subjects. The proceedings closed with a vote of thanks, proposed by Mr. Hudson, the local chairman of the Society of S.E.E.

Cardiff Centre

During the past three years it has been the custom for Cardiff Centre to devote three or four days during each session to a series of lectures to school children. This has resulted in the educational value of the Society's standard lecture becoming widely known throughout South Wales and Monmouthshire.

During the latter part of November a request was received from the Principal of the Abersychan Technical Institute for the assistance of the Cardiff Centre in arrangements for the annual Christmas celebrations held jointly by the Technical Institute, Grammar School, and Girls' Secondary School.

On Thursday, December 16, the Society's standard lecture was given to an enthusiastic audience of over 300 girls and boys, between the ages of 14 and 17. As the lecture was to be followed by a Christmas party, several innovations were included in the proceedings, which were appropriate to the general Christmas atmosphere which prevailed. The lecturer, Mr. D. C. James, who has had many years of experience in youth movements, and his assistant, Mr. W. Seward, gained immense popularity with their competition, during which a team of two from each of the three schools engaged in a filament stretching contest, and later

(Continued on page 23)

Forthcoming I.E.S. Meetings

(Provisional List)

MEETINGS AND VISITS IN LONDON

1949.

Feb. 8th. Sessional Meeting. MR. L. C. RETTIG on **The Lighting of Churches.** (*At the Lighting Service Bureau, 2, Savoy Hill, London, W.C.2.*) **6 p.m.**

Feb. 22nd. Visit. To the London Palladium to see the stage lighting. **10.45 a.m.** (Tickets only.)

Mar. 8th. Sessional Meeting. MR. W. HARRISON on **The Colour of Fluorescent Lamps.** (*At the Lighting Service Bureau, 2, Savoy Hill, London, W.C.2.*) **6 p.m.**

Mar. 23rd. Informal Meeting. Discussion **—That Standardisation Impedes Progress in Lighting.** (*At Gas Industry House, 1, Grosvenor Place, S.W.1.*) **6 p.m.**

MEETINGS OF CENTRES AND GROUPS

1949.

Feb. 2nd. MR. C. R. BICKNELL on **The Application of Modern Flash Discharge Tubes.** (*At the Minor Durant Hall, Oxford Street, Newcastle-on-Tyne.*) **6.15 p.m.**

Feb. 3rd. DR. J. W. MITCHELL on **High Speed Photography.** (*At the South Wales Institute of Engineers, Park Place, Cardiff.*) **5.45 p.m.**

Feb. 3rd. MR. H. R. RUFF on **Transport Vehicle Lighting.** (*At Exeter.*)

Feb. 4th. MR. H. R. RUFF on **Transport Vehicle Lighting.** (*At the Grand Hotel, Bristol.*) **7 p.m.**

Feb. 4th. DR. W. E. HARPER and MR. H. P. WALKER on **Acrylic Plastics in Lighting.** (*At the City of Nottingham Gas Dept. Demonstration Theatre, Parliament Street, Nottingham.*) **5.30 p.m.**

Feb. 4th. Open Discussion. (*At the Electricity Showroom. Market Street, Huddersfield.*) **7.15 p.m.**

1949.

Feb. 7th. MR. D. C. JAMES on **Store and Display Lighting.** (*At the Medical Library, The University, Western Bank, Sheffield, 10.*) **6 p.m.**

Feb. 10th. MR. W. J. P. WATSON on **Church Lighting Systems.** (*At the Electricity Demonstration Theatre, Charles Street, Leicester.*) **6.30 p.m.**

Feb. 10th. MR. G. GRENFELL BAINES on **Lighting of Architecture.** (*At the Reynolds Hall, Manchester College of Technology, Sackville Street, Manchester.*) **6 p.m.**

Feb. 10th. DR. A. J. HOLLAND on **Glass in the Service of Light.** (*At 45–53, Sunbridge Road, Bradford.*) **7.30 p.m.**

Feb. 14th. DR. J. H. NELSON on **Industry and Colour.** (*At the Electricity Offices, Whitehall Road, Leeds.*) **6 p.m.**

Feb. 15th. MR. N. L. HARRIS on **New Lamp Developments.** (*At the David Lewis Theatre, Great George Street, Liverpool.*) **7.30 p.m.**

Feb. 24th. MR. H. R. RUFF and MR. H. L. PRIVETT on **Black Light, Its Effects and Applications.** (*At the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow, C.2.*) **6 p.m.**

Feb. 25th. Annual General Meeting and Presidential Address by MR. J. M. WALDRAM. (*At the Imperial Hotel, Temple Street, Birmingham.*) **6 p.m.**

Feb. 25th. MR. H. R. RUFF and MR. H. L. PRIVETT on **Black Light, Its Effects and Applications.** (*At the Heriot Watt College, Chambers Street, Edinburgh.*) **6.30 p.m.**

Mar. 2nd. MR. J. WARD on **The Application of Polarised Light.** (*At the Minor Durant Hall, Oxford Street, Newcastle-on-Tyne.*) **6.15 p.m.**

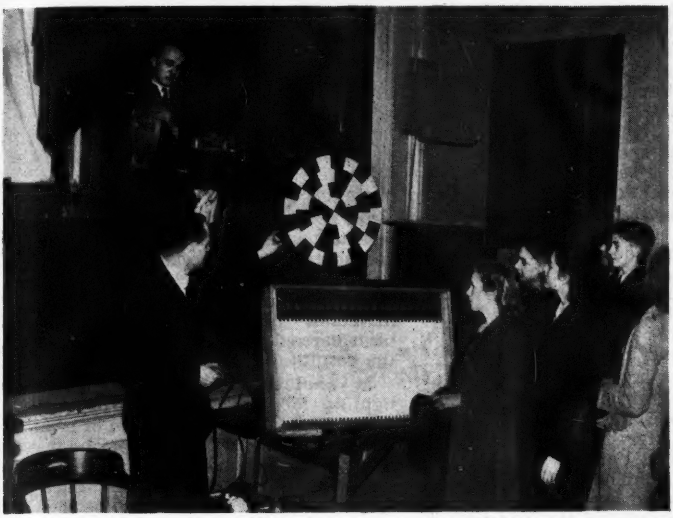
Mar. 3rd. MR. H. R. RUFF on **Transport Vehicle Lighting.** (*At Exeter.*)

Mar. 4th. MR. H. R. RUFF on **Transport Vehicle Lighting.** (*At the Grand Hotel, Bristol.*) **7 p.m.**

Mar. 4th. MR. ALAN W. JERVIS on **The Lighting of Large Retail Stores.** Joint Meeting with the E.C.A. (*At the Gas Dept. Demonstration Theatre, Parliament Street, Nottingham.*) **5.30 p.m.**

Mar. 4th. MR. W. A. R. STOYLE on **The Operation and Maintenance of Fluorescent Lamp Installations.** (*At the Electricity Showrooms, Market Street, Huddersfield.*) **7.15 p.m.**

(Secretaries of Centres and Groups are requested to send in particulars of any changes in programmes, mentioning subject, author, place, date and time of meeting: summaries of proceedings at meetings (which should not exceed about* 250–500 *words) and any other local news are also welcome.)



Mr. H. R. Ruff and some members of the audience at the recent lectures to school children at Huddersfield.

(Photograph by courtesy of the Huddersfield Examiner.)

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brought the house down with a beauty competition, in which they made up two of the senior boys with fluorescent materials and then irradiated their faces with ultra violet light.

A vote of thanks to the Society and the lecturers was proposed by Mr. T. S. Winsor, Principal of the Technical Institute, and seconded by Mr. W. Rees, H. M. Schools Inspector for Monmouth Area.

Huddersfield Group

The Huddersfield Group have also been very active in the field of lectures to school children, and this session arranged with Mr. H. R. Ruff to give his lecture entitled, "Rainbow Magic," to the pupils of the secondary schools in the Huddersfield district on December 7 and 8.

The lectures received an enthusiastic welcome from all, and particularly from the school children themselves, as was evident from the attention given and the questions asked. The demonstrations included the apparent lighting of an electric lamp with a match, interruption of music from a loudspeaker by the lifting of a hand, and the lighting of a bulb without the use of any wires or electrical connections. These and other unusual experiments were all used to demonstrate various sections of the electro-magnetic spectrum. The uses of fluorescent materials in the production of light were also dealt with.

Leeds Centre

At the third sessional meeting of the Leeds Centre, North Midland area, held on Monday, December 13, Mr. J. W. Howell presented a paper entitled, "School Lighting."

Mr. Howell introduced his subject by drawing comparisons between indoor daylight and outdoor daylight, and indicated that the majority of schools had been designed with daylight as the only means of illumination.

The author made reference to the increase in eye defects throughout school years compared with decreases in other bodily ailments, and attributed this disparity to the scant attention paid to seeing conditions. He emphasised that the problem was even more acute now that evening classes were in general operation, resulting in a working day of approximately 12 hours.

Mr. Howell mentioned the introduction of the new British Code of Practice CP324-102 (1948): "Provision of Electric Lighting in Schools," and stressed the desirability of conforming to the recommendations laid down therein. The speaker then turned his attention to

quality of light, and pointed out the recommendations designed for the minimisation of glare. He emphasised that the luminaire was only part of a lighting scheme, and that quality of light was very dependent upon the physical characteristics of the room. Improvements could be made, he said, in the room decorations so that undue brightness contrasts were avoided and a higher efficiency achieved in the construction of furniture and books, so that light matt finishes were provided, and in the design of chalkboards. A possible arrangement for the latter, he stated, was one which had received the approval of the Board of Education and involved the use of a yellow board and blue chalk.

Mr. Howell showed illustrations of several typical lighting layouts, and commented upon the various features, making particular reference to the localised board lighting which, he emphasised, should be at least as good as the horizontal desk lighting.

He finally introduced the question of controlling the installation by photo-electric means, expressing the opinion that human control was too unreliable. An automatic system, he emphasised, ensured that the artificial lighting became operative at the appropriate time and that nobody suffered through someone's forgetfulness or lack of judgment.

Contributors to the discussion which followed were: Dr. E. C. Walton, Messrs. A. G. Smith, N. D. Smith, H. B. Mellor, A. Wilde, A. Wilcock, R. D. Green, P. G. Harrison, and F. S. Polden.

Photo-electric control appeared to be the chief point of interest, many speakers expressing the view that since prime cost was strictly limited with school lighting, it was folly to consider an expensive control system and thereby detract from the actual installation.

Newcastle Centre

On December 1 last the Newcastle Centre had a talk from one of their own members, Mr. W. A. Dodgson, his subject being "Some Unusual Lighting Installations" in which he described, with slides, a number of installations, mainly of exterior lighting, with which he had been associated.

An installation with which he had been personally connected was that of lighting an enclosed ship building berth. The method adopted was a system of overhead lighting combined with a two-deck formation of lighting at the sides of the berth by means of angle type fittings. On the side lighting installation the lower row of fittings was at 50 ft. and the second row at 70 ft. The overhead lighting varied in height from approximately 100 ft. to 110 ft., the difference being the declivity of the berth.

On a further installation the problem was to suitably light an ore bank to enable two gantry cranes operating on parallel tracks to lift the ore from each side of the bank. Mr. Dodgson explained in detail the experiments which had been carried out and showed graphs of the results obtained.

In another case, the problem was lighting for the operation of sorting tacks. Ordinary lighting, even of a fairly high level, was unsatisfactory, and it was finally decided that the tray in which the tacks were sorted should have an opalescent screen base and be lighted from underneath, the overhead lighting serving chiefly to lessen the contrast between the opalescent screen and the surroundings.

Another interesting application to which the speaker referred was that of shipboard lighting with fluorescent tubes. He pointed out the difficulties which were often obtained on board ship in that the ceiling was generally the upper deck in which it was difficult to recess fittings.

After the talk Mr. H. L. James, the chairman, invited the discussion and was opened by the immediate past-chairman of the Centre, Mr. C. Fielding, who is associated with a large ship-building yard on the Tyne. He was followed by several other speakers.

Mr. Dodgson in replying to the discussion said that on the point of glare he agreed that as the building of the ship proceeded the riveters on the side of the hull may be disturbed by the nearness of the light source but that he felt this could not be too great a disadvantage as they had received no complaints and the type of installation he had described had been extended to other berths of a similar type.

In thanking the speaker for the paper Mr. J. S. McCulloch expressed the satisfaction of the Centre in having one of their own members give such an interesting paper.

The EDITOR Replies

One of our correspondents is anxious that the use of the term "lumen/sq. ft." should be discussed in the columns of *Light and Lighting*. He suggests that, whilst a very good case can be made out for the use of "luminance" and of "foot-lambert" in place of the misleading "brightness" and "equivalent foot-candle, the argument in favour of the change from "foot-candle" (which is popular usage amongst architects, engineers, and others who deal with lighting matters without themselves being lighting specialists) is not so apparent.

The fact, he says, that lumen/sq. ft. is logical seems contrary to our national characteristics! But whether we are more or less illogical than other nations is itself a question likely to provoke much discussion, though we cannot enter into it here. Nevertheless, the logic of lumen/sq. ft. seems to us a strong argument in its favour, though it must be admitted that a satisfactory shortened form of it, comparable with "lux" is desirable.

Our correspondent thinks the continued use of "foot-candle" in American publications tends to weigh rather heavily, as these journals give guidance to architects in a form which they ofen find easily assimilable. But it was not until late in 1945 that, after careful consideration, "lumen/sq. ft." was adopted in our own I.E.S. code, and it may yet find favour with our American friends.

However, it should be interesting to make known the views of some of our readers who cannot voice them as members of committees on terminology and usage. While it is not our practice to publish correspondence, if readers care to send us their views on the subject opened in these notes we will be glad to summarise them on this page in forthcoming issues of the journal.

It has been suggested that lighting engineers might folow the electrical practice of giving units a "catalogue name," e.g., "watt," "ampere," "henry," etc. Thus we already have the "lambert," and, if "foot-candle" is to be replaced by another term, our present correspondent feels it might be preferable to choose a "catalogue name" rather than "lumen/sq. ft." His own view, however, is that "foot-candle" is good enough as a catalogue name to justify its retention.

Another correspondent has sent us a cutting from a recent issue of a national daily newspaper, reporting that a doctor in a well-known seaside resort has asked the British Medical Association to assist him in an investigation into the effects of fluorescent lighting. It appears that several of his patients who have had a facial rash, for which he cannot account on the usual grounds, have all been exposed to fluorescent lighting. Presumably he suspects an overdose of U.V., but if this be the case it must be remembered that "natural" U.V. radiation is more abundant in seaside than in many inland towns (this being one of the claims of seaside towns as *health* resorts), and this is a much more likely cause of the trouble than is fluorescent lighting, if, indeed, U.V. is blameworthy at all.

Yet another query comes from a borough medical officer of health, who is concerned to know whether there is any truth in the statement that "fluorescent lighting causes sterility"? This statement is even more astounding than that of the business man who did not like fluorescent lighting in his office because it is "too hot"!

SITUATIONS VACANT

SITUATION WANTED

I.E.S. Discussion on I.C.I. Meeting

(Continued from page 5)

could sit comfortably round one table to a figure of well over 300 delegates. Further, there was difficulty in arranging for the presentation of authors' papers without encroaching on the time needed for the presentation and adequate discussion of secretariat reports. Now, when the secretariat was being transferred to the U.S.A., was probably an appropriate time to overhaul the whole organisation. Dr. Walsh said that he felt a great deal of useful work had been done in the unofficial discussions between individual delegates outside the meetings. He concluded by paying a tribute to Dr. English, who had so ably taken over at very short notice the responsibility of leading the British delegation, and to the members of the delegation who had so worthily maintained the high reputation of Great Britain as a country which had always contributed much to the success of the Commission's meetings.

Personal

On December 1 Mr. D. A. Strachan took up a new appointment as lighting engineer at the headquarters of the National Coal Board in London.

Mr. Strachan was formerly senior lighting engineer at the head office of Metropolitan-Vickers Electrical Co., Ltd., having formerly been at the Newcastle branch of that company.

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Mr. D. E. Mutch, formerly with the lighting department of Philips Electrical, Ltd., has been appointed lighting engineer to Courtney, Pope (Electrical), Ltd., as from January 1. He takes the place of Mr. Bernard Gurr, who is now assistant secretary of the Association of Supervising Electrical Engineers.

It is announced that Mr. E. A. Fowler, M.I.E.E., F.I.E.S., is relinquishing his present appointment as assistant general manager of Electricity House, Ltd., Bramhope, nr. Leeds, which concern is controlled by the British Electricity Authority. Mr. Fowler is joining Thorn Electrical Industries, Ltd., in the capacity of branch director, and from January, 1949, will direct the whole of that company's activities in the North of England, Scotland, and Northern Ireland from the Stevenson-square, Manchester, offices.

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Mr. Fowler has held responsible positions in the electrical supply, installation, and manufacturing sections of the industry, embracing sales development work and administration, and has also successfully completed many extensive industrial electrification schemes throughout the country. He is at present a vice-chairman of the I.E.E. North Midland Centre, and immediate past chairman of the I.E.E. Utilisation Group and I.E.S. Centre of that area.

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Mr. E. Smith, who formerly represented the lighting department of Philips Electrical, Ltd., in Leeds, and who, until recently, was hon. secretary of the Leeds I.E.S. Centre, has now joined Messrs. Simplex Electric Co., Ltd., at Oldbury, Birmingham.

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